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# MM1 - ESMini™ COM with Intel® Atom™

- **Intel® Atom™ Z530 or Z510, up to 1.6 GHz**
- **Up to 1 GB DDR2 SDRAM**
- **1 PCI Express®**
- **Up to 2 Fast Ethernet interfaces**
- **8 USB 2.0 (1 client)**
- **2 UARTs**
- **Up to 2 CAN bus interfaces**
- **SDVO, LVDS**
- **Intel® HD Audio**
- **-40°C to +85°C Tcase screened (-25°C to +85°C Tcase with 1 GB DRAM)**
- **Conduction cooling**

The MM1 is an ultra-small Computer-On-Module of the rugged ESMini™ family. Together with an application-specific carrier board it forms a semi-custom solution for industrial, harsh, mobile and mission-critical environments.
The MM1 is controlled by the Intel® Atom™ processor, a first generation IA-32 core based on 45nm process technology. Due to the new power architecture of the Intel® Atom™ CPU, the MM1 has a total power consumption of max. 5 to 10 W, while having a clock frequency of up to 1.6 GHz.
The MM1 accommodates up to 1 GB of directly soldered main memory and supports other memory like USB Flash on the carrier board.
The MM1 offers a multitude of I/O: besides modern serial I/O like one PCI Express® x1 link, LVDS, SDVO, high-definition audio, SATA and USB, it also provides legacy I/O (2 CAN, 2 COM, 2 Fast Ethernet, 2 I2C) and up to 120 FPGA signals.
The MM1 is completed by a board management controller for temperature and power supervision. It comes with a Phoenix® Award BIOS configurable for the final application.
The MM1 is screened for operation in a -40°C to +85°C temperature range (Tcase, -25°C to +85°C for board versions with 1 GB DRAM). As all ESMini™ modules it is embedded in a covered frame. This ensures EMC protection and allows efficient conductive cooling.
Air cooling is also possible by applying a heat sink on top of the cover. Where operation temperatures are moderate, the module may even do without the frame and cover, with a suitable low-power processor and airflow. ESMini™ modules are firmly screwed to a carrier board and come with rugged industry-proven connectors supporting high frequency and differential signals. Only soldered components are used to withstand shock and vibration, and the design is optimized for conformal coating. The MM1 supports a 95x55mm form factor.
For evaluation and development purposes a microATX carrier board is available.



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# Technical Data

### CPU
- Intel® Atom™ Z530 or Z510
  - Up to 1.6 GHz processor core frequency
  - 400 MHz or 533 MHz system bus frequency
- Chipset
  - Intel® system controller hub US15W

### Memory
- 512 KB L2 cache integrated in Atom processor
- Up to 1 GB DDR2 SDRAM system memory
  - Soldered
  - 400/533 MHz memory bus frequency locked to the FSB frequency

### Serial ATA (SATA)
- One port via ESMini™ connector
- Transfer rates up to 100 MB/s
- Via PATA-to-SATA converter

### Graphics
- Integrated in Intel® System Controller Hub US15W
- Maximum resolution: 1366x768 pixels
- 1 SDVO port
- 1 LVDS port
  - 112 MHz maximum pixel clock
  - 18 or 24 bits pixel color depths
- Available via ESMini™ connector

### USB
- Eight USB 2.0 host ports (or 7 host ports and 1 client port, adjustable by software)
  - Via ESMini™ connector
  - Six of these ports also support USB 1.1 (UHCI implementation)
- EHCI implementation
- Data rates up to 480 Mbit/s

### Ethernet
- Up to two 10/100Base-T Ethernet channels
- Two status LEDs per channel
- Available via ESMini™ connector

### UART
- Two interfaces
- RS232 or RS422/RS485
- Full or half-duplex
- Data rates up to 115,200 bit/s
- 60-byte transmit/receive buffer
- Handshake lines: RTS, CTS
- Available via ESMini™ connector

### CAN bus
- Two CAN bus channels
- 2.0 A/B CAN protocol
- Data rates up to 1 Mbit/s
- Available via ESMini™ connector

### I²C Bus
- Two interfaces
- Available via ESMini™ connector

### PCI Express®
- One x1 link to connect legacy I/O (FPGA)
- One x1 link via ESMini™ connector
- Data rate 250 MB/s in each direction (2.5 Gbit/s per lane)

### GPIO
- One line from board controller on ESMini™ connector J1
- Three lines from FPGA on ESMini™ connector J1
- Up to 19 differential pairs of receive and transmit lines on ESMini™ connector J2
- Up to 116 single I/O lines on ESMini™ connector J2

### HD Audio
- Via ESMini™ connector

### Board Management Controller
- Input voltage supervision
- Power sequencing
- Board monitoring
- Watchdog
- Accessible via SMBus

### Miscellaneous
- Real-time clock (with Goldcap or battery backup on the carrier board)
- SMBus interface

### Electrical Specifications
- Supply voltage: +5V (-3%/+5%)
- Power consumption:
  - 1.1 GHz Z510 model: 6.75 W typ., 7.7 W max.
  - 1.6 GHz Z530 model: 7.5 W typ., 9.3 W max.

### Mechanical Specifications
- Dimensions: 95 mm x 55 mm
- ESMini™ PCB mounted between a frame and a cover
- Weight: 130 g (with cover and frame)

### Environmental Specifications
- Temperature range (operation):
  - -40..+85°C Tcase (ESMini™ cover/frame) (screened) (board versions with 512 MB DDR2 SDRAM)
  - -25..+85°C Tcase (ESMini™ cover/frame) (screened) (board versions with 1 GB DDR2 SDRAM)

# Technical Data

- Temperature range (storage): -40..+85°C
- Relative humidity (operation): max. 95% non-condensing
- Relative humidity (storage): max. 95% non-condensing
- Altitude: -300 m to + 3,000 m
- Shock: 15 g/11 ms (EN 60068-2-27)
- Bump: 10 g/16 ms (EN 60068-2-29)
- Vibration (sinusoidal): 1 g/10..150 Hz (EN 60068-2-6)
- Conformal coating on request

**MTBF**

- 221,026 h @ 40°C according to IEC/TR 62380 (RDF 2000)

**Safety**

- PCB manufactured with a flammability rating of 94V-0 by UL recognized manufacturers

**EMC**

- EMC behavior depends on the system and housing surrounding the ESMini™ module. MEN has performed general, successful EMC tests for ESMini™ using the XC4 evaluation carrier according to EN 55022 (radio disturbance), IEC 61000-4-2 (ESD), IEC 61000-4-3 (electromagnetic field immunity), IEC 61000-4-4 (burst), IEC 61000-4-5 (surge) and IEC 61000-4-6 (conducted disturbances)

**BIOS**

- Award BIOS

**Software Support**

- Windows®
  - Windows® XP
  - Windows® Vista™
  - Windows® 7
  - Windows® XP Embedded
  - Windows® Embedded Standard 7
- Linux (in preparation)
- VxWorks® (on request)
- QNX® (on request)
- For more information on supported operating system versions and drivers see Software.

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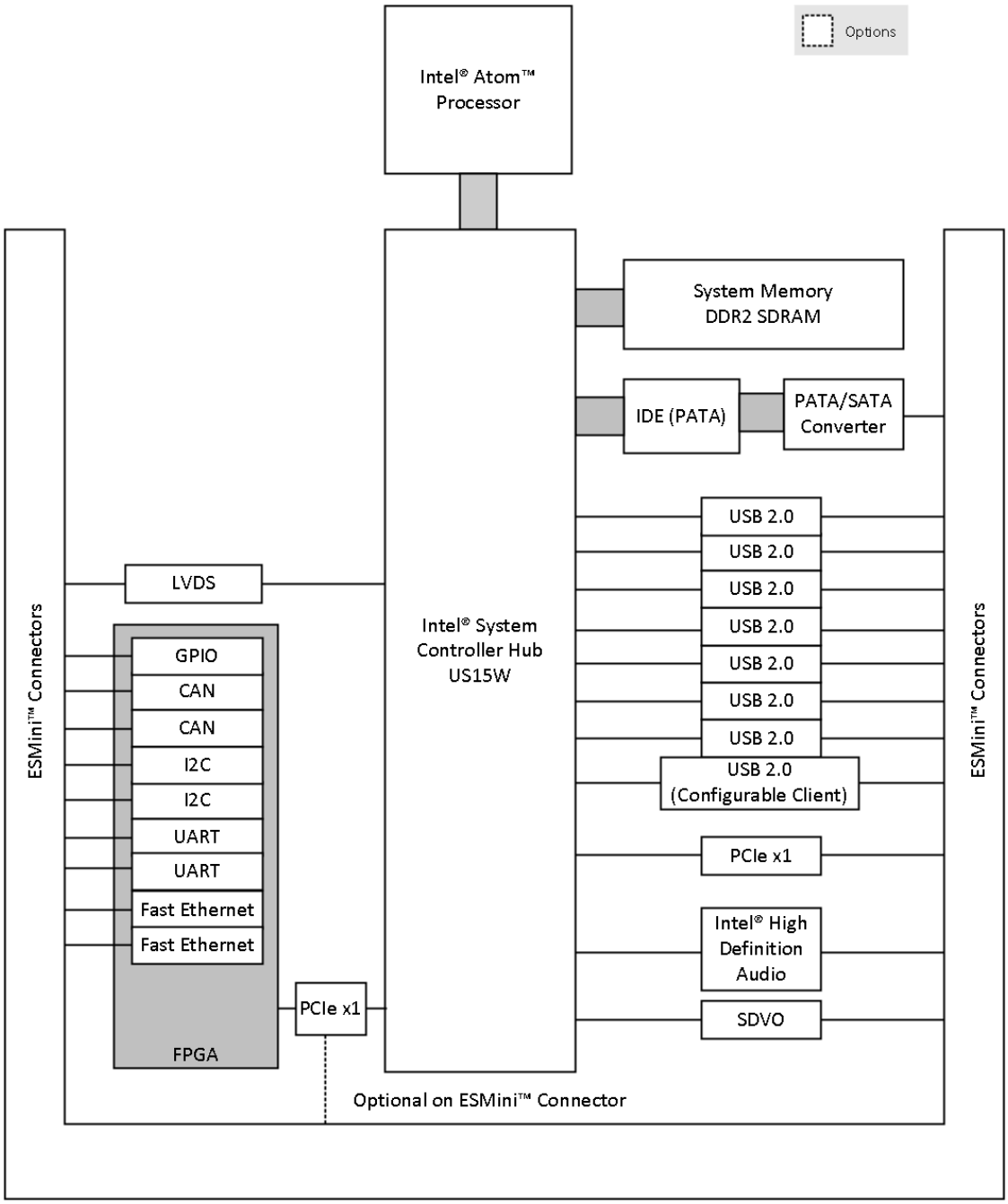
## Diagram



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# Configuration & Options

## Standard Configurations

| Article No. | CPU Type | Clock | System RAM | Ethernet | CAN | ESMini™ Connectors | Operating Temperature |
|---|---|---|---|---|---|---|---|
| 15MM01-00 | Z510 | 1.1 GHz | 512 MB | 1 | 1 | J1 | -40..+85°C Tcase screened |
| 15MM01-01 | Z530 | 1.6 GHz | 1 GB | 2 | 2 | J1, J2 | -25..+85°C Tcase screened |

## Options

### CPU
- Intel® Atom™ Z530, 1.6 GHz
- Intel® Atom™ Z510, 1.1 GHz

### Memory
- System RAM
  - 512 MB or 1 GB

### I/O
- Second Fast Ethernet port
- Second CAN port

### PCI Express®
- Second PCI Express® lane on ESMini™ connector
  - Instead of FPGA (GPIO, CAN, UART, Fast Ethernet, I²C)

### Operating Temperature
- -40..+85°C Tcase (ESMini™ cover/frame) (screened) (board versions with 512 MB DDR2 SDRAM)
- -25..+85°C Tcase (ESMini™ cover/frame) (screened) (board versions with 1 GB DDR2 SDRAM)

### Cooling
- With cover and frame
- With cooling plate
- With small heat sinks only on processor and chipset

### BIOS
- Accessible via UART using VT100 terminal

### Software Support
- VxWorks® (on request)
- QNX® (on request)

**Please note that some of these options may only be available for large volumes. Please ask our sales staff for more information.**

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# Ordering Information

### Standard MM1 Models

**15MM01-00** Intel® Atom™ Z510, 1.1 GHz, 512MB RAM, 1 Fast Ethernet, 1 CAN, -40..+85°C Tcase screened

**15MM01-01** Intel® Atom™ Z530, 1.6 GHz, 1GB RAM, 2 Fast Ethernet, 2 CAN, -25..+85°C Tcase screened

### Related Hardware

**08XC04-00** Evaluation and development board for all ESMini™ modules, 0..+60°C, incl. 2 GB USB Flash Disk and SA-Adapters™ for 1 RS232 and 1 CAN bus

**08XC06-01** Carrier board for ESMini™: 1x TTY, 1x RS232, 1x DVI-I, 1x Audio I/O, 4x USB2.0, 2x Fast Ethernet, USB Flash slot, PCI Express® Mini Card socket, SIM card holder, microSD™ card socket, 8x GPIOs, -40°C..+85°C screened

### Miscellaneous Accessories

**0712-0019** Standard ATX PSU, 350 W, 0..+40°C

**08XC04-00** Evaluation and development board for all ESMini™ modules, 0..+60°C, incl. 2 GB USB Flash Disk and SA-Adapters™ for 1 RS232 and 1 CAN bus

**08XC06-01** Carrier board for ESMini™: 1x TTY, 1x RS232, 1x DVI-I, 1x Audio I/O, 4x USB2.0, 2x Fast Ethernet, USB Flash slot, PCI Express® Mini Card socket, SIM card holder, microSD™ card socket, 8x GPIOs, -40°C..+85°C screened

### Software: Linux

This product is designed to work under Linux. See below for potentially available separate software packages from MEN.

**13XM01-06** MDIS5™ low-level driver sources (MEN) for XM1, XM1L, MM1, XM2, F11S, F19P, F21P, G20, SC21 and DC2 board controller

**13Z015-06** MDIS5™ low-level driver sources (MEN) for 16Z029_CAN (MSCAN/Layer2)

**13Z016-06** MDIS5™ driver (MEN) for 16Z029_CAN (CANopen master)

**13Z017-06** MDIS5™ low-level driver sources (MEN) for 16Z034_GPIO and 16Z037_GPIO

**13Z025-90** Linux native driver (MEN) for 16Z025_UART, 16Z057_UART and 16Z125_UART

**13Z077-90** Linux native driver (MEN) for 16Z077_ETH and 16Z087_ETH

### Software: Windows

This product is designed to work under Windows®. See below for potentially available separate software packages from MEN.

**10F014-78** Windows® XP Embedded BSP (MEN) for F11S, F14, F15, F17, F18, F19P, F21P, G20, XM1, XM1L, XM2, MM1, MM2, SC21, SC24, DC1, DC2, RC1 and BC50M

**10Y000-78** Windows® Embedded Standard 7 BSP for F11S, F19P, F21P, G20, XM1L, XM2, MM1, MM2, SC21, SC24, BC50M, F206, F210, F215, F216, G215, P506, P507 and P511

**13MM01-77** Windows® Installset (MEN) for MM1 and RC1 [Includes all free drivers developed by MEN for the supported hardware.]

**13T009-70** Windows® HD audio driver (Realtek) for XM1, XM1L, MM1, MM2

**13T011-70** Windows® graphics driver (Intel®) for XM1, XM1L, MM1 and F11S

**13T012-70** Windows® XP/Vista chipset driver (Intel®) for XM1, XM1L, MM1 and F11S

**13T013-70** Windows® USB client driver installation package (Intel®) for XM1, XM1L and MM1

**13T014-70** Windows® Vista™ HD audio driver (Realtek) for XM1, XM1L and MM1

**13T016-70** Windows® Vista™ chipset graphics driver (Intel®) for XM1, XM1L, MM1 and F11S

**13Z015-70** MDIS4™/2004/MDIS5™ Windows® driver (MEN) for 16Z029_CAN (MSCAN/Layer2)

**13Z016-70** MDIS5™ Windows® driver (MEN) for 16Z029_CAN (CANopen master)

**13Z017-70** MDIS4™/2004 / MDIS5™ Windows® driver (MEN) for 16Z034_GPIO devices

**13Z087-70** Windows® native driver (MEN) for 16Z087_ETH (Ethernet controller)

### Software: Firmware/BIOS

MEN's CANopen firmware consists of the Vector Informatik protocol stack. The corresponding driver software comes from MEN. It is based on MDIS™ (MEN Driver Interface System), which makes the hardware ready for use under Windows®, Linux, VxWorks®, QNX®, OS-9® and other software environments. You can find more information on the Vector CANopen tools at www.vector-informatik.de.

### Software: Miscellaneous



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# Ordering Information

Intel® software development products such as analyzers, compilers, threading tools etc. can be downloaded under www.intel.com/cd/software/products/asmo-na/eng/index.htm. IA-32 Intel® Architecture Software Developer's Manuals are available under www.intel.com/products/processor/manuals/index.htm.

For operating systems not mentioned here contact MEN sales.

### Documentation

Compare Chart ESMini™ Computer-On-Modules Download

You can find general literature on MEN computer-on-modules, including presentations about ESMexpress®, ESMini™ and their cooling concept, in our Download Library.

| | |
|---|---|
| **20APPN004** | Application Note: How to make a USB stick bootable |
| **20MM01-ER** | MM1 Errata |
| **20MM01-00** | MM1 User Manual |
| **21Z025-90** | 16Z025_UART and 16Z125_UART under Linux User Manual |

**For the most up-to-date ordering information and direct links to other data sheets and downloads, see the MM1 online data sheet under » www.men.de.**

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